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# Study on Paddy Grain from Axial Flow Rice Thresher

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## ABSTRACT

An axial flow rice thresher with drum length of 4 feet was tested to evaluate the performance under different drum speed and feeding rate. The rice variety of Luang Pathan which had 13.6% grain moisture content, 10.2% straw moisture content, 60.6% grain ratio and 71 cm cut crop length was used. Grain output of the thresher was investigated cracked grain and checked the braken grain in milling test grain. From the result of the test, total losses due to broken, unthreshed and blown grain were about 1% when onload drum speed was nearly 600 rpm. The cracked grain ratio and the broken grain ratio in milled grain were increased with the rising up of the onload drum speed. At the onload drum speed of 600 rpm, the cracked and broken grain ratios were about 3% and 6% respectively.

## INTRODUCTION

At present, rice threshing practices by mechanical threshers are widely adopted by Thai farmers. The use of rice thresher increases labour productivity (Sukharomana, 1983). It requires less labour imput and threshing period than traditional methods. The mechanical threshers used are almost throw-in axial flow type (Chirnaksorn, 1990). Whole materials of harvested rice bundles are fed into the thresher and conveyed spirally along the threshing drum axis of the thresher. Grains recieved from the thresher are ready for selling. The price of grains will be decided by the middle man, purchaser, after the quality of grains were investigated. In case of many broken grains and crack inside grain are founded, the price of the grains will be deceased.

From the testing and evaluation of the axial flow rice thresher with drum length of 4 feet, this paper specially demonstated the effect of the use of the thresher to the quality of the recieved grains in term of broken and cracked grain ratios.

## MATERIALS AND METHODS

### Research Materials

1. Rice rhresher. An axial flow rice thresher with drum length of 4 feet was used to test at defferent drum speeds and feeding rates. The thresher was consisted of main component parts and working pattern shown in Figure 1.

Rice bundles arranged on the feeding tray were fed into the threshing chamber through the feeding chute. The threshing drum conveyed them to impact and rub with the concave. Threshed grain was then dropped drown through concave opening to the oscillanting screen below while straw was forced along the axis of the threshing drum and sent out from the straw outlet.

On the screen, the fallen threshed grain, chaff and foriegn materials were exposed to air stream provided by the blower installed under the oscillating screen. Impurities and chaff were blown out from chaff outlet whereas threshed grain dropped down on the screw conveyor to be carried throught the main grain outlet. Some threshed grains that blown out together with impurities were trapped inside the apron and retrived for recycling by the return auger.

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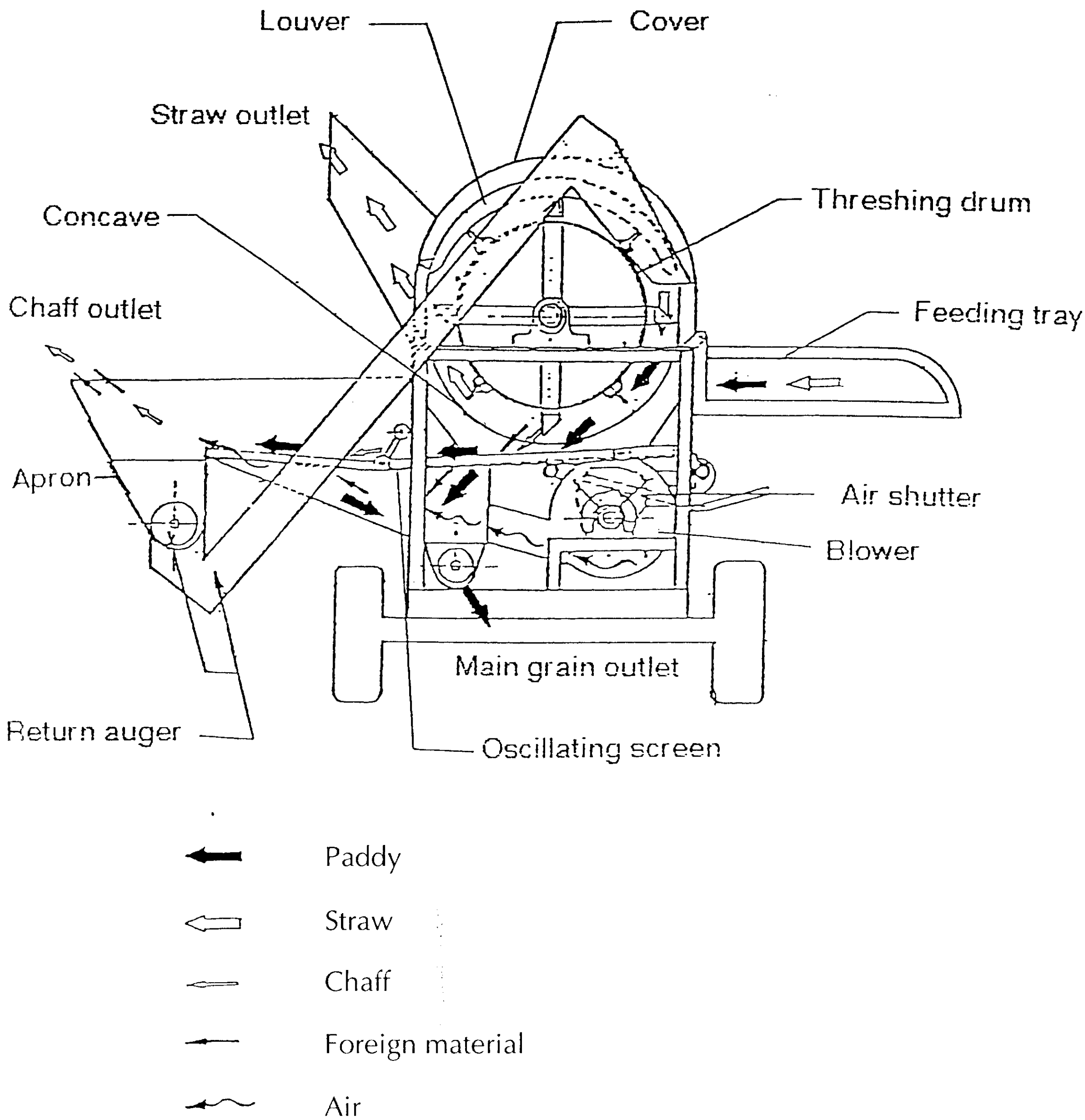



**Figure 1 Main component parts and working pattern of AF rice thresher.**

2. Rice bundles. The variety of Luang Pathan was used throughout the test. The rice had 60.6% grain ratio, 13.6% grain moisture content (wet basis). 10.2% straw moisture content (wet basis) and 71 cm. cut crop length.

3. Instruments. The test set up for the experiment was shown in Figure 2. Electrical dynamometer (Takachiho Seki medel S-4) was used to drive the thresher. The power requirement of the thresher was measured by PS meter (Denshikogyo model TDM-HR-5L) and recorded by recorders (Kyowa model RTP-600A and Rikadenki model R55M3). Speed of the threshing drum was mesured by lighting tachometer (Onosoki model HT-431) and recorded by digital printer (Onosoki model RQ-335)

4. Sample collectors. Threshed grains were collected in bags while straw and chaff were collected by large nets.

5. Grain investigators. Threshed grains from main grain outlet were investigated inside crack grain by x-ray (softex, E-5) of Central Laboratory and Greenhouse Complex (CLGC) and checked broken

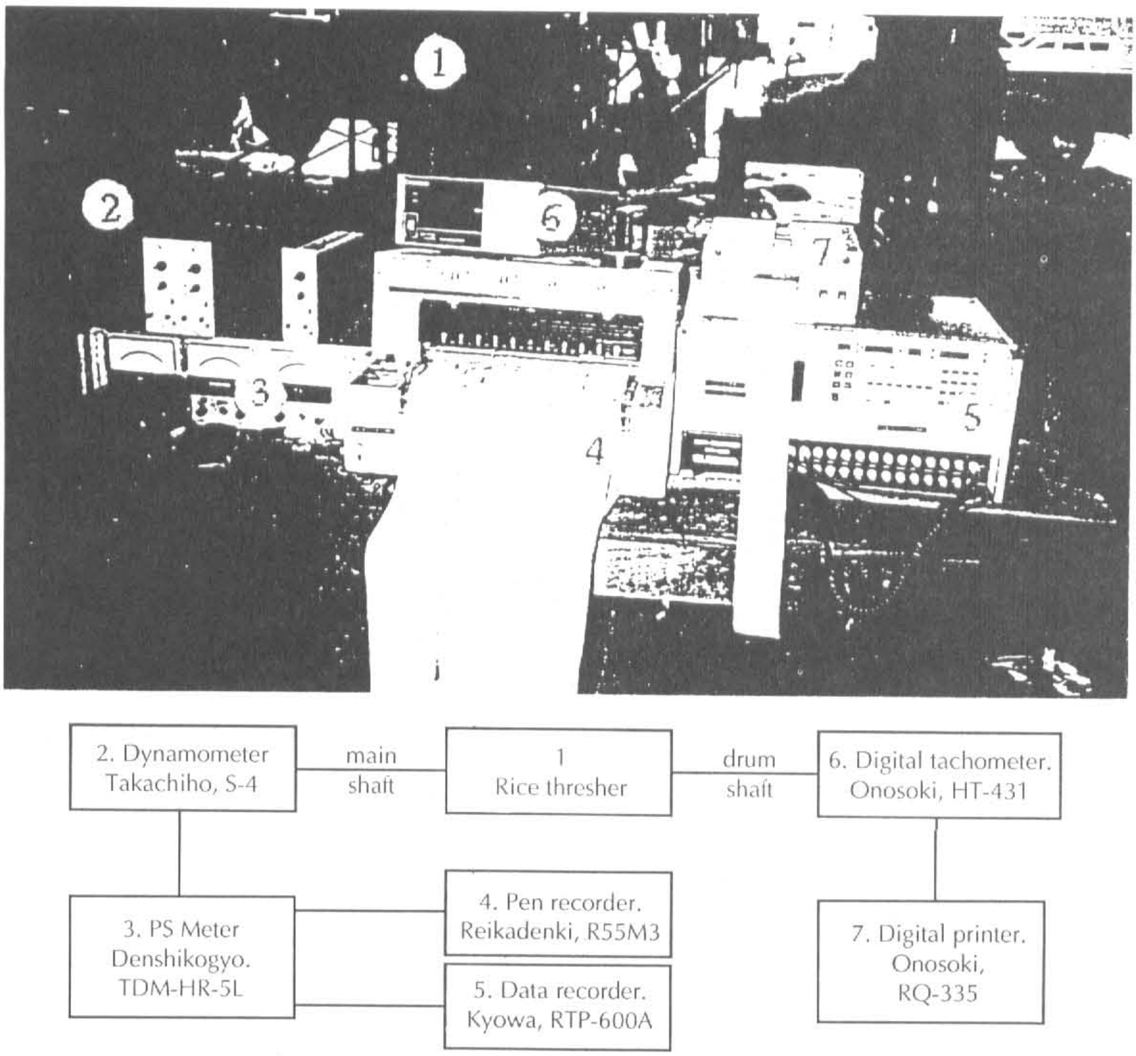



**Figure 2 Instruments set up for testing the thresher.**

grain from milling machine (Satake Rice Machine Type THU) (Figure 3)

**Procedure**

Prior to the test, rice conditions and machine details were recorded.

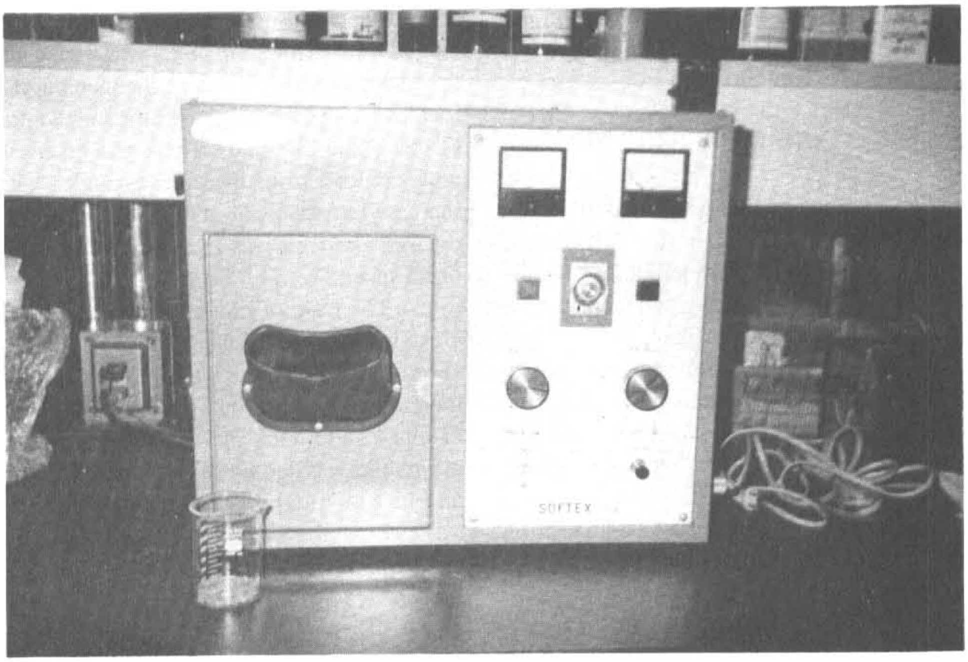
When the thresher was started, the measurements of the speed of dynamometer, threshing drum, oscillating screen, blower and screw conveyors were carried out.

In a test run, a noload drum speed and a feeding rate were predetermined. Then rice bundles were fed at the predetermined rate continuously. During the test run, samples from the main grain, chaff and straw outlets were collected in 20 seconds. The onload drum speed and power requirement of the thresher were also measured and recorded at the same time.

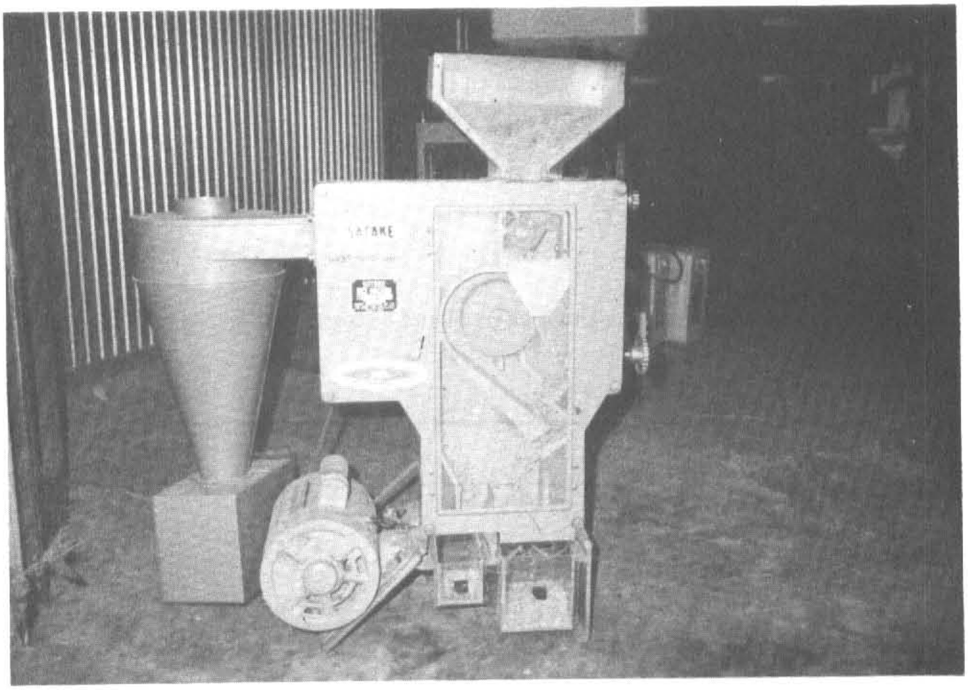
A new test run with other predetermined noload drum speed and feeding rate was carried out when the former test run finished. The noload drum speeds and feeding rates were set up at 500, 550, 600, 650, 700, 750 and 800 rpm and 2600, 3600 and 4800 kg/h. in whole material bases.

After the test, the collected samples from 3 outlets which were good, branches and broken grains were subjected to calculate for determining the efficiency and performance of the thresher (Thai Standard Institute, 1987)

The grains from main grain outlet of each test run were sampled for two groups, 500 g each. The first group was sent to check the inside crack grain by softex x-ray at CLGC. The other group was tested by




3.1 Softex x-ray, E-5




3.2 Rice milling machine
Satake Rice Machine, THU

**Figure 3 Equipments for checking quality of grain.**

passing through milling machine. The milled grains were sepatated to good and broken grain for calculation the good and broken grain ratio.

## RESULTS AND DICSUSSIONS

The details of the rice thresher used in the test was shown in Table 1. The result of rice threshing by the axial flow thresher with drum length of 4 feet at onload drum speeds of 420-710 rpm and feeding rates of 2600-4800 kg/h was shows in Table 2. Total loss was about 1% when the onload drum speed was nearly 600 rpm and it was increasing when the onload drum speed was rised up and slow down (Figure 4.) The reason of this thinking as follows, when the onload drum speed was too low the separation loss (grain loss from straw outlet) was high and when the onload drum speed was too high the blower loss (grain blown out from chaff outlet) was high (Figure 5.)

The ratio of crached grain in the grains recieved from main grain outlet was varied when drum speed and feeding rate were changed but it tended to increase with the rising up of the onload drum speed (Table 3 and Figure 6). There was no cracked grain when onload drum speed was under 450 rpm. It increased to about 3% at 600 rmp and the maximum cracked grain rete was 7% at about 700 rpm of onload drum speed.

The ratio of broken grain in milled grain recieved from the milling test was varied when drum speed and feeding rate were changed but it tended to increase with the rising up of the onload drum speed (Table 4 and Figure 7). It was found that the broken grain retio was about 3% at 440 rpm. 6% at 600 rpm and 11% at 700 rpm of onload drum speed

From the test, it can be inferred that the speed of threshing drum affect to the quality of grain, the ratio of cracked and broken grain. The much more

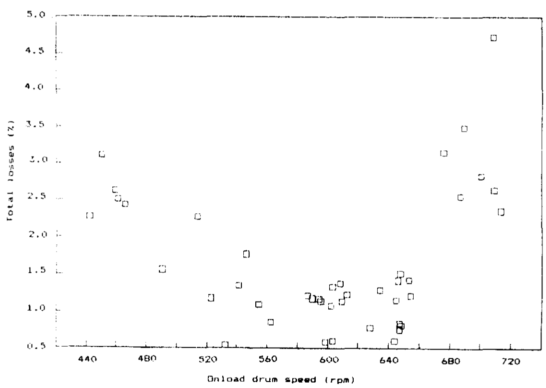



Figure 4 Total losses of 4 feet axial flow rice thresher.

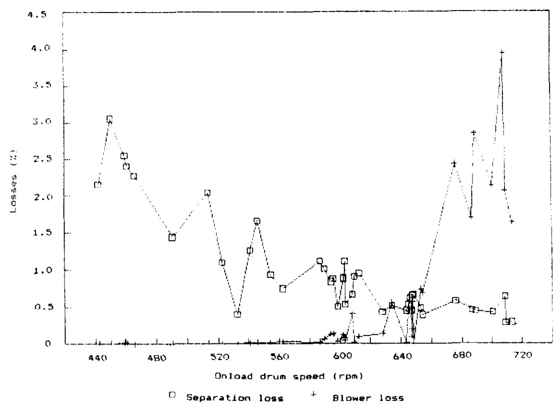



Figure 5 Losses of 4 feet axial flow rice thresher.

**Table 1 Specifications of 4 feet axial flow rice thresher.**

| item | Details |
|---|---|
| 1. Dimemsion | |
| - Length, cm. | 332 |
| - Width, cm. | 254 |
| - Heigh, cm | 266 |
| 2. Threshing drum | |
| - Diameter, cm | 49 |
| - Length, cm. | 121.9 |
| - Spiketooth (row * no. in row) | 8*15 |
| - Clearance under spiketooth, cm. | 1.5 |
| 3. Concave | 0.6 cm. steel rods with 1.5 cm. clearance |
| 4. Oscilating screen | perforated steel plate with 1.5 cm. hole size |
| 5. Blower | Centrifugal type. |
| 6. Adjusment | Air shutters on blowers drum speed |
| 7. Labor requirdment | 8 |

**Table 2** Determenation of efficieancy, losses, capacity and quality of grain.

| Feed Rate kg/h | Drum Noload rpm | speed Onload rpm | Total grain output kg/h | onload torque kg.m | onload power PS | onload power kW | Separation loss % | Blower loss % | damaged grain % | Total loss % | Branch grain % | Threshing eff. % | Cleaning eff. % | Grain capacity kg/h | Grain specific capacity kg/h/kW | Cracked grain % | MIlled Good grain % | Grain Broken grain % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2600 | 500 | 442.4 | 972.04 | 4.20 | 4.98 | 3.66 | 2.16 | 0.01 | 0.09 | 2.27 | 6.56 | 93.44 | 91.57 | 950.93 | 259.62 | 0 | 96.66 | 3.34 |
| 2600 | 500 | 459.5 | 752.54 | 3.45 | 4.83 | 3.55 | 2.56 | 0.02 | 0.05 | 2.63 | 8.30 | 91.70 | 99.41 | 733.11 | 206.37 | 0 | 96.56 | 3.44 |
| 2600 | 500 | 465.8 | 765.49 | 3.30 | 4.53 | 3.33 | 2.27 | 0.00 | 0.16 | 2.44 | 7.08 | 92.92 | 91.23 | 748.05 | 224.52 | 2 | 94.34 | 5.66 |
| 2600 | 550 | 513.8 | 787.37 | 3.30 | 5.43 | 3.99 | 2.03 | 0.01 | 0.23 | 2.28 | 5.42 | 94.58 | 91.50 | 771.26 | 193.12 | 2 | 95.76 | 4.21 |
| 2600 | 600 | 554.3 | 774.13 | 3.60 | 6.26 | 4.60 | 0.93 | 0.02 | 0.14 | 1.09 | 6.91 | 93.09 | 91.30 | 766.79 | 166.54 | 1 | 94.76 | 5.24 |
| 2600 | 600 | 562.4 | 873.55 | 3.45 | 6.19 | 4.55 | 0.74 | 0.03 | 0.08 | 0.85 | 5.72 | 94.28 | 91.88 | 866.79 | 190.39 | 2 | 94.85 | 5.15 |
| 2600 | 650 | 602.0 | 852.78 | 3.60 | 7.09 | 5.21 | 0.88 | 0.12 | 0.08 | 1.08 | 4.43 | 95.57 | 94.03 | 844.27 | 161.90 | 0 | 95.98 | 4.02 |
| 2600 | 650 | 609.2 | 861.11 | 3.45 | 6.79 | 4.99 | 0.90 | 0.01 | 0.21 | 1.13 | 3.97 | 96.03 | 93.21 | 853.21 | 170.85 | 0 | 95.33 | 4.67 |
| 2600 | 700 | 594.0 | 1596.01 | 4.50 | 9.36 | 6.88 | 0.83 | 0.13 | 0.21 | 1.17 | 3.08 | 96.92 | 94.65 | 1580.71 | 229.61 | 3 | 92.50 | 7.50 |
| 2600 | 700 | 612.4 | 1376.52 | 4.50 | 9.36 | 6.88 | 0.95 | 0.10 | 0.18 | 1.23 | 4.95 | 95.05 | 92.94 | 1362.15 | 197.86 | 3 | 93.57 | 6.43 |
| 2600 | 700 | 643.8 | 969.99 | 4.20 | 8.30 | 6.10 | 0.45 | 0.02 | 0.12 | 0.60 | 4.31 | 95.69 | 93.39 | 965.40 | 158.14 | 2 | 94.97 | 5.03 |
| 2600 | 700 | 647.3 | 1009.44 | 4.20 | 8.23 | 6.05 | 0.45 | 0.10 | 0.28 | 0.83 | 4.40 | 95.60 | 92.16 | 1003.87 | 165.84 | 3 | 92.61 | 7.39 |
| 2600 | 700 | 648.0 | 909.00 | 4.20 | 8.53 | 6.27 | 0.66 | 0.00 | 0.14 | 0.81 | 3.53 | 96.47 | 95.14 | 902.97 | 143.93 | 5 | 93.54 | 6.46 |
| 2600 | 700 | 653.0 | 711.15 | 4.20 | 7.77 | 5.71 | 0.49 | 0.73 | 0.20 | 1.42 | 2.73 | 97.27 | 94.49 | 702.47 | 122.92 | 6 | 88.98 | 11.02 |
| 2600 | 750 | 608.0 | 1103.98 | 4.28 | 9.66 | 7.10 | 0.66 | 0.40 | 0.31 | 1.37 | 2.42 | 97.58 | 96.22 | 1092.29 | 153.74 | 2 | 94.60 | 5.40 |
| 2600 | 800 | 700.2 | 1039.60 | 4.05 | 8.91 | 6.55 | 0.42 | 2.13 | 0.28 | 2.83 | 2.49 | 97.51 | 94.54 | 1013.05 | 154.59 | 2 | 93.58 | 6.42 |
| 2600 | 800 | 708.6 | 689.59 | 4.28 | 9.58 | 7.05 | 0.63 | 3.93 | 0.16 | 4.72 | 5.58 | 94.42 | 93.76 | 658.13 | 93.40 | 3 | 92.11 | 7.89 |
| 2600 | 800 | 709.0 | 907.65 | 3.98 | 8.68 | 6.38 | 0.28 | 2.07 | 0.29 | 2.63 | 2.42 | 97.58 | 95.12 | 886.38 | 138.84 | 7 | 90.39 | 9.61 |
| 3600 | 500 | 450.2 | 810.35 | 3.90 | 5.28 | 3.88 | 3.06 | 0.01 | 0.04 | 3.12 | 5.32 | 94.68 | 92.98 | 785.44 | 202.25 | 0 | 95.51 | 4.49 |
| 3600 | 500 | 460.9 | 689.59 | 3.60 | 4.83 | 3.55 | 2.41 | 0.01 | 0.09 | 2.50 | 6.26 | 93.74 | 91.67 | 672.92 | 189.42 | 0 | 94.29 | 5.71 |
| 3600 | 550 | 490.4 | 999.43 | 3.60 | 5.74 | 4.22 | 1.44 | 0.01 | 0.11 | 1.56 | 6.73 | 93.27 | 90.03 | 984.96 | 233.30 | 1 | 96.29 | 3.71 |
| 3600 | 600 | 541.1 | 1142.74 | 4.05 | 7.09 | 5.21 | 1.26 | 0.02 | 0.06 | 1.34 | 7.66 | 92.34 | 86.78 | 1128.16 | 216.34 | 2 | 94.91 | 5.09 |
| 3600 | 600 | 545.9 | 927.89 | 4.05 | 6.94 | 5.10 | 1.65 | 0.02 | 0.08 | 1.76 | 4.23 | 95.77 | 94.37 | 912.32 | 178.73 | 3 | 94.94 | 5.06 |
| 3600 | 650 | 595.3 | 702.85 | 4.05 | 7.40 | 5.44 | 0.87 | 0.14 | 0.12 | 1.13 | 6.07 | 93.93 | 92.05 | 695.74 | 127.83 | 2 | 94.12 | 5.88 |
| 3600 | 650 | 598.6 | 1154.95 | 3.90 | 7.40 | 5.44 | 0.50 | 0.04 | 0.05 | 0.59 | 4.47 | 95.53 | 93.21 | 1148.77 | 211.07 | 1 | 95.06 | 4.94 |
| 3600 | 700 | 589.6 | 1183.60 | 4.65 | 9.36 | 6.88 | 1.00 | 0.07 | 0.10 | 1.17 | 4.13 | 95.87 | 93.51 | 1170.91 | 170.08 | 2 | 92.97 | 7.03 |
| 3600 | 700 | 603.0 | 959.07 | 4.50 | 9.21 | 6.77 | 1.11 | 0.08 | 0.14 | 1.32 | 3.56 | 96.44 | 94.32 | 947.73 | 139.91 | 1 | 95.07 | 4.93 |
| 3600 | 700 | 627.9 | 858.18 | 4.65 | 9.25 | 6.80 | 0.43 | 0.13 | 0.22 | 0.78 | 1.90 | 98.10 | 97.72 | 853.36 | 125.43 | 6 | 91.59 | 8.41 |
| 3600 | 700 | 644.7 | 1075.72 | 4.50 | 8.91 | 6.55 | 0.53 | 0.43 | 0.19 | 1.15 | 1.51 | 98.49 | 97.53 | 1065.39 | 162.57 | 4 | 92.34 | 7.66 |
| 3600 | 750 | 645.8 | 1253.12 | 4.35 | 9.06 | 6.66 | 0.62 | 0.66 | 0.12 | 1.41 | 4.43 | 95.57 | 94.15 | 1237.02 | 185.64 | 2 | 94.57 | 5.43 |
| 3600 | 750 | 647.4 | 1164.16 | 4.35 | 9.81 | 7.22 | 0.65 | 0.56 | 0.29 | 1.50 | 3.80 | 96.20 | 94.12 | 1150.08 | 159.40 | 4 | 93.50 | 6.50 |
| 3600 | 800 | 689.1 | 895.38 | 4.13 | 9.06 | 6.66 | 0.44 | 2.85 | 0.20 | 3.49 | 4.06 | 95.94 | 94.70 | 865.88 | 129.94 | 4 | 90.59 | 9.41 |
| 3600 | 800 | 709.4 | 633.14 | 3.90 | 8.60 | 6.33 | 1.03 | 0.00 | 0.21 | 1.24 | 3.41 | 96.59 | 95.18 | 626.61 | 99.06 | 5 | 88.83 | 11.17 |
| 4800 | 600 | 522.7 | 1356.25 | 4.35 | 7.40 | 5.44 | 1.09 | 0.00 | 0.07 | 1.17 | 3.28 | 96.72 | 94.85 | 1341.35 | 246.45 | 2 | 96.91 | 3.09 |
| 4800 | 600 | 532.5 | 1303.91 | 4.20 | 7.17 | 5.27 | 0.40 | 0.00 | 0.14 | 0.55 | 3.39 | 96.61 | 94.97 | 1298.58 | 246.25 | 1 | 95.99 | 4.01 |
| 4800 | 650 | 586.5 | 966.75 | 4.20 | 7.70 | 5.66 | 1.10 | 0.03 | 0.08 | 1.21 | 3.71 | 96.29 | 94.13 | 955.82 | 168.77 | 1 | 94.31 | 5.69 |
| 4800 | 650 | 603.3 | 1026.50 | 3.75 | 7.40 | 5.44 | 0.54 | 0.05 | 0.02 | 0.60 | 4.02 | 95.98 | 93.87 | 1020.51 | 187.50 | 0 | 91.90 | 8.10 |
| 4800 | 700 | 634.0 | 1049.43 | 3.60 | 8.45 | 6.21 | 0.51 | 0.55 | 0.22 | 1.28 | 4.18 | 95.82 | 93.61 | 1038.27 | 167.06 | 1 | 92.55 | 7.45 |
| 4800 | 700 | 647.3 | 1145.43 | 4.20 | 8.30 | 6.10 | 0.44 | 0.19 | 0.12 | 0.75 | 3.47 | 96.53 | 94.39 | 1138.18 | 186.44 | 4 | 94.07 | 5.93 |
| 4800 | 750 | 654.4 | 1363.20 | 4.35 | 9.81 | 7.22 | 0.39 | 0.68 | 0.14 | 1.21 | 2.11 | 97.89 | 97.44 | 1348.56 | 186.90 | 5 | 93.17 | 6.83 |
| 4800 | 750 | 675.9 | 1058.48 | 4.40 | 9.36 | 6.88 | 0.58 | 2.43 | 0.16 | 3.16 | 4.63 | 95.37 | 94.18 | 1026.66 | 149.13 | 3 | 94.60 | 5.40 |
| 4800 | 800 | 686.7 | 1490.41 | 4.58 | 11.00 | 8.09 | 0.46 | 1.69 | 0.40 | 2.55 | 2.49 | 97.51 | 96.04 | 1458.28 | 180.25 | 6 | 93.09 | 6.91 |
| 4800 | 800 | 713.6 | 1253.12 | 4.35 | 9.81 | 7.22 | 0.29 | 1.62 | 0.44 | 2.35 | 2.93 | 97.07 | 95.17 | 1229.16 | 170.36 | 7 | 90.76 | 9.24 |

**Table 3 Cracked grain ratio of 4 feet AF rice thresher (by x-ray).**

| Feed rate kg/h | Onload drum speed rpm | Cracked grain % | | | | Cracked grain reg. % |
|---|---|---|---|---|---|---|
| 2600 | 442.4 | 0 | Regression Output: | | | -0.25 |
| 2600 | 459.5 | 0 | Constant | | -8.10 | 0.05 |
| 2600 | 465.8 | 2 | Std Err of Y Est | | 1.49 | 0.17 |
| 2600 | 513.8 | 2 | R Squared | | 0.46 | 1.02 |
| 2600 | 554.3 | 1 | No. of Observations | | 43.00 | 1.74 |
| 2600 | 562.4 | 2 | Degrees of Freedom | | 41.00 | 1.88 |
| 2600 | 594.0 | 3 | | | | 2.44 |
| 2600 | 602.0 | 0 | X coefficient (s) | 0.02 | | 2.58 |
| 2600 | 608.0 | 2 | Std Err of Coef. | 0.00 | | 2.69 |
| 2600 | 609.2 | 0 | | | | 2.71 |
| 2600 | 612.4 | 3 | | | | 2.77 |
| 2600 | 643.8 | 2 | | | | 3.32 |
| 2600 | 647.3 | 3 | | | | 3.38 |
| 2600 | 648.0 | 5 | | | | 3.40 |
| 2600 | 653.0 | 6 | | | | 3.49 |
| 2600 | 700.2 | 2 | | | | 4.32 |
| 2600 | 708.6 | 3 | | | | 4.47 |
| 2600 | 709.0 | 7 | | | | 4.48 |
| 3600 | 450.2 | 0 | | | | -0.11 |
| 3600 | 460.9 | 0 | | | | 0.08 |
| 3600 | 490.4 | 1 | | | | 0.60 |
| 3600 | 541.1 | 2 | | | | 1.50 |
| 3600 | 545.9 | 3 | | | | 1.59 |
| 3600 | 589.6 | 2 | | | | 2.36 |
| 3600 | 595.3 | 2 | | | | 2.46 |
| 3600 | 598.6 | 1 | | | | 2.52 |
| 3600 | 603.0 | 1 | | | | 2.60 |
| 3600 | 627.9 | 6 | | | | 3.04 |
| 3600 | 644.7 | 4 | | | | 3.34 |
| 3600 | 645.8 | 2 | | | | 3.39 |
| 3600 | 647.4 | 4 | | | | 3.39 |
| 3600 | 689.1 | 4 | | | | 4.13 |
| 3600 | 709.4 | 5 | | | | 4.49 |
| 4800 | 522.7 | 2 | | | | 1.17 |
| 4800 | 532.5 | 1 | | | | 1.35 |
| 4800 | 586.5 | 1 | | | | 2.31 |
| 4800 | 603.3 | 0 | | | | 2.60 |
| 4800 | 634.0 | 1 | | | | 3.15 |
| 4800 | 647.3 | 4 | | | | 3.38 |
| 4811 | 654.4 | 5 | | | | 3.51 |
| 4800 | 675.9 | 3 | | | | 3.89 |
| 4800 | 686.7 | 6 | | | | 4.08 |
| 4800 | 713.6 | 7 | | | | 4.56 |

**Table 4 Good and broken grain ratio from milling test of the grain output.**

| Feed rate kg/h | Onload Drum speed rpm | Milling Good grain % | Test Broken grain % | | | Regression Good grain (Reg.) % | Regression Broken grain (Reg.) % |
|---|---|---|---|---|---|---|---|
| | | | | Good grain | | | |
| 2600 | 442.4 | 96.66 | 3.34 | Regression Output: | | 96.64 | 3.36 |
| 2600 | 459.5 | 96.56 | 3.44 | Constant | 104.59 | 96.33 | 3.67 |
| 2600 | 465.8 | 94.34 | 5.66 | Std Err of Y Est | 1.41 | 96.22 | 3.78 |
| 2600 | 513.8 | 95.79 | 4.21 | R Squared | 0.49 | 95.35 | 4.65 |
| 2600 | 554.3 | 94.76 | 5.24 | No. of Observations | 43.00 | 94.63 | 5.37 |
| 2600 | 562.4 | 94.85 | 5.15 | Degress of Freedom | 41.00 | 94.48 | 5.52 |
| 2600 | 594.0 | 92.50 | 7.50 | | | 93.91 | 6.09 |
| 2600 | 602.0 | 95.98 | 4.02 | X Coefficient (s) | -0.02 | 93.77 | 6.23 |
| 2600 | 608.0 | 94.60 | 5.40 | Std Err of Coef. | 0.00 | 93.66 | 6.34 |
| 2600 | 609.2 | 95.33 | 4.67 | | | 93.64 | 6.36 |
| 2600 | 612.4 | 93.57 | 6.43 | | | 93.58 | 6.42 |
| 2600 | 643.8 | 94.97 | 5.03 | | | 93.02 | 6.98 |
| 2600 | 647.3 | 92.61 | 7.39 | | | 92.95 | 7.05 |
| 2600 | 648.0 | 93.54 | 6.46 | | | 92.94 | 7.06 |
| 2600 | 653.0 | 88.98 | 11.02 | | | 92.85 | 7.15 |
| 2600 | 700.2 | 93.58 | 6.42 | | | 92.00 | 8.00 |
| 2600 | 708.6 | 92.11 | 7.89 | | | 91.85 | 8.15 |
| 2600 | 709.0 | 90.39 | 9.61 | | | 91.85 | 8.15 |
| 3600 | 450.2 | 95.51 | 4.49 | | | 96.50 | 3.50 |
| 3600 | 460.9 | 94.29 | 5.71 | | | 96.30 | 3.70 |
| 3600 | 490.4 | 96.29 | 3.71 | | | 95.77 | 4.23 |
| 3600 | 541.1 | 94.91 | 5.09 | | | 94.86 | 5.14 |
| 3600 | 545.9 | 94.94 | 5.06 | | | 94.78 | 5.22 |
| 3600 | 589.6 | 92.97 | 7.03 | | | 93.99 | 6.01 |
| 3600 | 595.3 | 94.12 | 5.88 | | | 93.89 | 6.11 |
| 3600 | 598.6 | 95.06 | 4.94 | Broken grain | | 93.83 | 6.17 |
| 3600 | 603.0 | 95.07 | 4.93 | Regression Output: | | 93.75 | 6.25 |
| 3600 | 627.9 | 91.59 | 8.41 | Constant | -4.59 | 93.30 | 6.70 |
| 3600 | 644.7 | 92.34 | 7.66 | Std Err of Y Est | 1.41 | 93.00 | 7.00 |
| 3600 | 645.8 | 94.57 | 5.43 | R Squared | 0.49 | 92.98 | 7.02 |
| 3600 | 647.4 | 93.50 | 6.50 | No. of Observations | 43.00 | 92.95 | 7.05 |
| 3600 | 689.1 | 90.59 | 9.41 | Degrees of Freedom | 41.00 | 92.20 | 7.80 |
| 3600 | 709.4 | 88.83 | 11.17 | | | 91.84 | 8.16 |
| 4800 | 522.7 | 96.91 | 3.09 | Coefficient (s) | 0.02 | 95.19 | 4.81 |
| 4800 | 532.5 | 95.99 | 4.01 | Std Err of Coef. | 0.00 | 95.02 | 4.98 |
| 4800 | 586.5 | 94.31 | 5.69 | | | 94.05 | 5.95 |
| 4800 | 603.3 | 91.90 | 8.10 | | | 93.74 | 6.26 |
| 4800 | 634.0 | 92.55 | 7.45 | | | 93.19 | 6.81 |
| 4800 | 647.3 | 94.07 | 5.93 | | | 92.95 | 7.05 |
| 4800 | 654.4 | 93.17 | 6.83 | | | 92.83 | 7.17 |
| 4800 | 675.9 | 94.60 | 5.40 | | | 92.44 | 7.56 |
| 4800 | 686.7 | 93.09 | 6.91 | | | 92.25 | 7.75 |
| 4800 | 713.6 | 90.76 | 9.24 | | | 91.76 | 8.24 |

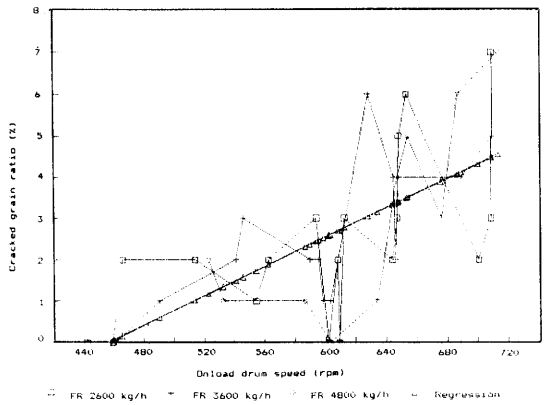



**Figure 6 Cracked grain ratio in the grain output of 4 feet axial flow rice thresher.**

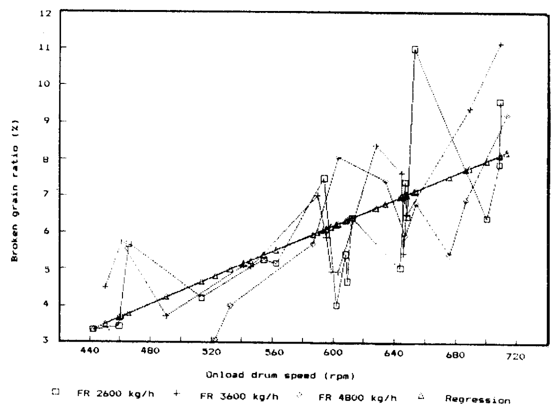



**Figure 7 Broken grain ratio in the milled grain of the grain output.**

high speed of threshing drum used, the worse quality of grain recieved because the higher drum speed produced the higher impact and rubbing action. Regarding to the total loss, cracked and broken grain ratio of this test the appropriate onload drum speed should be between 580 to 640 rpm.

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